WATER RESOURCES REVIEW for JANUARY 1977

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

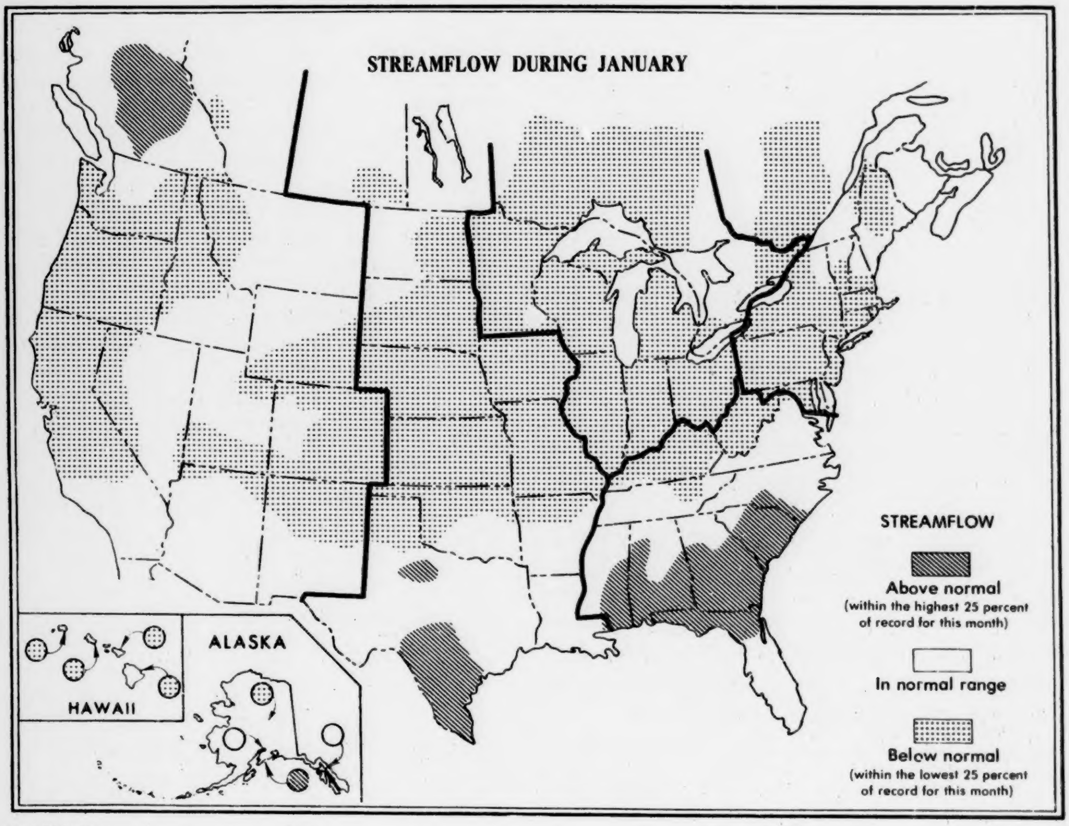
STREAMFLOW AND GROUND-WATER CONDITIONS

Serious drought conditions prevail in many northern and western States where a far below-normal snowpack was reported. Streamflows in the below-normal range persisted in many north-central and western States and decreased into that range in Kentucky, West Virginia, and most of the Northeastern United States.

Streamflow generally decreased in southern Canada, Alaska, Hawaii, and most of the northern two-thirds of the United States but increased in many southern States as well as in parts of California, Oregon, Washington, and Wisconsin.

Monthly and daily mean flows were lowest of record in the Western Great Lakes region and in parts of the Midcontinent and West regions and in Alaska and Hawaii.

Above-normal flows persisted in parts of several southeastern States, Alaska, and Texas and increased into that range in British Columbia.



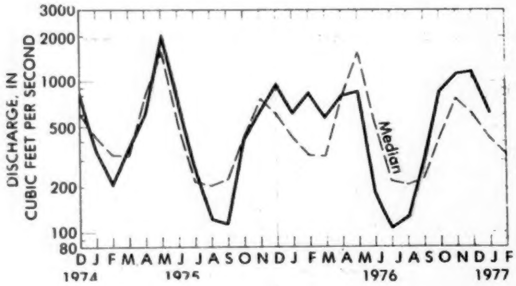
CONTENTS:

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow generally decreased seasonally throughout the region but increased in parts of Maryland, New York, and Rhode Island. Monthly mean flows remained in the below-normal range in parts of Massachusetts, New Jersey, Pennsylvania, and Quebec and decreased into that range in most of the remaining States in the region.

Monthly mean flows decreased seasonally in the Atlantic Provinces and were generally in the normal range. In eastern Nova Scotia, monthly mean discharge at the index station, Northeast Margaree River at Margaree Valley, decreased sharply into the normal range as a result of below-normal temperatures. (See graph.)



Monthly mean discharge of Northeast Margaree River at Margaree Valley, Nova Scotia (Drainage area, 142 sq mi; 368 sq km)

Similarly, in Quebec, streamflow decreased seasonally and was generally in the normal range except in the St. Maurice and Coulonge River basins where flows remained in the below-normal range for the 3d consecutive month at about 50 percent of the median flow.

Also, in Maine, flows decreased seasonally and were generally in the below-normal range. The monthly mean flow at Piscataquis River at Dover-Foxcroft decreased sharply and was below the normal range for the first time since January 1976. In northern Maine, flow of the St. John River below Fish River as measured at Fort Kent, decreased into the below-normal range and was less than 60 percent of the median flow for January.

In New Hampshire, the lowest January runoff of record occurred at the index station, Lamprey River near New Market (period of record, 42 years). Also, in Massachusetts, the 2d lowest monthly mean discharge of record occurred at Ware River at Coldbrook where flows remained in the below-normal range for the 3d consecutive month.

In Rhode Island, monthly mean discharge at Branch River at Forestdale increased seasonally but remained in the below-normal range for the 3d consecutive month.

In Connecticut, streamflow remained in the below-normal range for the 2d consecutive month at Burlington Brook near Burlington and decreased into that range at the remaining index stations in the State.

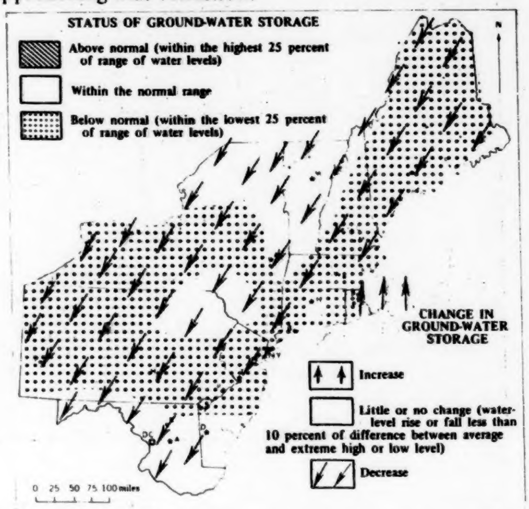
In New York, monthly mean flows generally decreased seasonally as a result of below-normal temperatures and were below the normal range at all index stations in the State except for Hudson River at Hadley where normal flows prevailed.

In Pennsylvania, streamflow decreased contraseasonally at all four index stations and remained in the below-normal range for the 2d consecutive month at Oil Creek at Rouseville, and decreased into that range in the remainder of the State.

Similarly, streamflow in New Jersey was in the below-normal range as a result of below-normal temperatures during the month. At the index station, Great Egg Harbor River at Folsom, monthly mean discharge decreased contraseasonally and remained in the below-normal range for the 2d consecutive month and was less than 70 percent of median.

In western Maryland, streamflow decreased due to prolonged subfreezing weather and was below the normal range at Seneca Creek at Dawsonville for the first time since March 1974. In the eastern part of the State, streamflow increased but remained in the normal range.

Ground-water levels declined in nearly the entire region. (See map.) Little or no recharge of aquifers occurred in those areas because of frozen ground and persistent sub-freezing temperatures. Levels rose in a few parts of southeastern New England, and changed only slightly in Delaware, coastal parts of New Jersey, and on Long Island, N.Y. By the end of the month, levels throughout the region were below average or approaching that condition.



Map shows ground-water storage near end of January and change in ground-water storage from end of December to end of January.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow generally decreased contraseasonally in the northern part of the region and increased seasonally in the southern part. Flows remained above the normal range in parts of Alabama, Florida, Georgia, North Carolina, and South Carolina and decreased into the below-normal range in West Virginia and in parts of Kentucky and Tennessee.

In West Virginia, where January streamflow increases seasonally under normal conditions, monthly mean flows at all index stations decreased sharply as a result of below-normal temperatures and the formation of ice in the streams. In the southeastern part of the State, monthly mean discharge in Greenbrier River at Alderson decreased from 2,013 cfs in December (123 percent of median) to 435 cfs in January (17 percent of median). In the south-central and northwestern parts of the State, monthly mean flows in Kanawha River at Kanawha Falls and Potomac River at Paw Paw, respectively, also decreased contraseasonally, were in the below-normal range, and were about one-third the January median discharges.

In Virginia, streamflow also increases seasonally during January under normal conditions, but, as a result of below-normal temperatures and ice formation, monthly mean discharges decreased sharply in all parts of the State and were about three-fourths of median for the month.

In Kentucky, where flows also increase seasonally during the winter months under normal conditions, the below-normal temperatures and ice in the streams resulted in monthly mean discharges appreciably less than those in December. In the northern part of the State, the monthly mean flow in Licking River at Catawba was below the normal range and only 21 percent of the January median. In south-central Kentucky, monthly mean discharge in Green River at Munfordville was about one-half of median and in the below-normal range.

In eastern Tennessee, streamflow also decreased contraseasonally. Monthly mean flow in Emory River at Oakdale was below the normal range and about one-half of the January median. In the western part of the State, monthly mean discharges increased seasonally and were in the normal range.

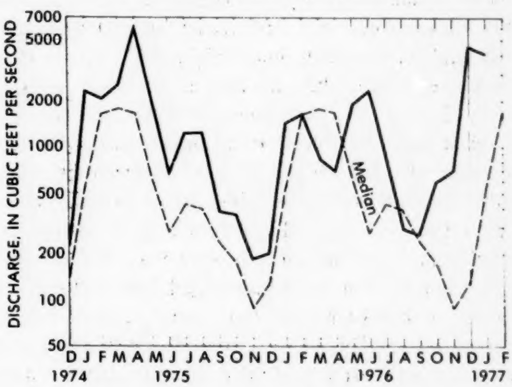
In southeastern Mississippi, monthly mean flow in Pascagoula River at Merrill increased seasonally and was above the normal range. In the adjacent basin of Pearl River, monthly mean discharge as measured near the State line, near Bogalusa, Louisiana, also increased seasonally, was in the above-normal range, and was about 3 times the January median flow.

In southeastern Alabama, where monthly mean discharge of Conecuh River at Brantley was in the above-normal range and 3 times median in December, flow decreased slightly in January but remained above the normal range for the 3d consecutive month. In the northwestern part of the State, monthly mean flow in Tombigbee River at Demopolis lock and dam, near Coatopa, increased sharply and was in the above-normal range.

In Pee Dee River basin in north-central South Carolina and the adjacent area of North Carolina, monthly mean flow, as measured at Peedee, S.C., decreased contraseasonally but remained above the normal range. Monthly mean discharge of Lynches River at Effingham, S.C. was nearly twice the median flow for January, and in the above-normal range for the 4th consecutive month.

In central and eastern parts of North Carolina, flows increased seasonally and were in the normal range.

In southern Georgia, monthly mean flow of Alapaha River (tributary to Suwannee River) at Statenville remained in the above-normal range for the 4th consecutive month and was about 8 times the January median flow. (See graph.) In the adjacent area of



Monthly mean discharge of Alapaha River at Statenville, Ga. (Drainage area, 1,400 sq mi; 3,626 sq km)

Suwannee River basin in northern Florida, monthly mean discharge of Suwannee River at Branford also remained above the normal range, and was 5 times median.

In the Apalachicola River basin in western Georgia and the adjacent area of southeastern Alabama and northwestern Florida, monthly mean discharge as measured at Chattahoochee, Florida, decreased

contraseasonally but remained in the above-normal range for the 4th consecutive month.

In extreme northwestern Florida, flow of Shoal River near Crestview also decreased contraseasonally and remained above the normal range for the 3d consecutive month. Flows were in the normal range in the central part of the State.

Ground-water levels in West Virginia declined in most of the State; levels were above average in a few western and southern boundary counties and below average elsewhere. In Kentucky, levels continued to rise in the downtown Louisville area, but declined slightly in the unpumped area southwest of the city and in most other parts of the State. Fluctuations have been minimal because of very low temperatures, reduced industrial activity, and deficient precipitation as rain. In Virginia, the level declined but was above average in the Tyler well in Louisa County, declined and was below average in the index well in Fairfax County, but rose and was above average in the Matoaka Manor well near Petersburg. In western Tennessee, a new low for January, for the 4th consecutive month, was reached in the key well in the "500-foot sand" near Memphis. Levels in North Carolina rose in the mountains and Piedmont, and remained steady in the Coastal Plain; they were above long-term averages across the entire State. In Mississippi, levels declined slightly—at most only 0.5 foot—in wells screened in the Sparta Sand in the Jackson area. The artesian pressure in the index well in Montgomery, in central Alabama, declined slightly and was slightly below average for the first time in several months; in Centreville, the pressure rose 1.7 feet and was at the average level for 24 years of record by the end of the month. In Georgia, levels in most of the wells in the Piedmont were about 1 foot higher than last month and last year. Levels of wells in and near the center of pumping in the Savannah area on the coast were about the same as last month, but ranged from 3 to 5 feet lower than last year. In the outlying area, levels were about 1 foot higher than last month, but were about 3 feet lower than last year. In Bryan and Liberty Counties south of Savannah, levels were about the same as last month, but were about 1 foot lower than last year. Still farther south, in the Brunswick area, levels in and near the center of pumping, and in the outlying area, were about 1 foot higher than last month, but 1 foot lower than last year. In Florida, water levels rose in the northwestern, north-central, and northeastern parts, but declined in the south-central and west-central parts of the State. Compared to last year, levels ranged from less than 1.0 foot higher at Jacksonville to 12 feet higher near Mulberry. In southeastern Florida, levels continued to decline, except in Palm Beach County, where levels rose slightly. Levels at the end of the month ranged from above average to 1.6 feet below average.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow generally decreased and remained below the normal range except in parts of Ontario. Monthly mean flows were lowest of record in parts of all States and also Ontario.

In Ontario, streamflow decreased seasonally and continued in the below-normal range except for the southeastern part of the Province. In eastern Ontario, the monthly mean discharge of Missinaibi River at Mattice (drainage area, 3,450 square miles) was below the normal range for the 9th consecutive month and the monthly mean of 159 cfs, and daily mean of 139 cfs on January 31 were lowest for the month in 57 years of record. In southwestern Ontario, monthly mean discharge in English River at Umfreville remained in the below-normal range for the 8th consecutive month, at 42 percent of median.

In Minnesota, streamflow remained in the below-normal range except for the southeastern corner of the State. In northeastern Minnesota, several streams recorded new lows of record, with the Baptism River near Beaver Bay (drainage area, 140 square miles) experiencing zero flow for the first time in 49 years of continuous record. Monthly mean flows at other index stations in the State were in the below-normal range and generally less than 50 percent of median.

In Wisconsin, streamflow generally increased contraseasonally at all index stations but remained in the below-normal range throughout the State. The January monthly mean discharge of 1,430 cfs at Fox River at Rapide Croche Dam near Wrightstown (drainage area, 6,150 square miles) was lowest in 80 years of record. Flows at the other index stations in the State remained about the same as December flows except for Wisconsin River at Muscoda. There, the monthly mean increased 33 percent, attributed to reservoir releases.

In Michigan's Upper Peninsula, the monthly mean discharge of 15.7 cfs at the index station, Sturgeon River near Sidnaw (drainage area, 171 square miles) was 25 percent of the median and a new monthly minimum of record for the 7th consecutive month. Streamflow at that index station has remained in the below-normal range since May 1976. Similarly, in Michigan's Lower Peninsula, below-normal flows persisted for the 5th consecutive month at the index station, Muskegon River at Evart.

Flows in Ohio decreased contraseasonally at all index stations because of below-normal temperatures and were

(Continued on page 6.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

[Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.]

Lake	January 31, 1977	Monthly mean, January		January		
		1977	1976	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	599.60	599.70	600.85	600.34	601.33 (1975)	598.58 (1926)
Michigan and Huron (Harbor Beach, Mich.)	578.05	578.15	579.22	577.72	579.92 (1973)	575.39 (1965)
St. Clair (St. Clair Shores, Mich.)	573.90	573.84	574.74	572.51	575.37 (1974)	569.86 (1936)
Erie (Cleveland, Ohio)	570.26	570.43	571.61	569.74	572.39 (1973)	567.62 (1935)
Ontario (Oswego, N.Y.)	243.85	243.92	244.32	243.99	246.10 (1946)	241.67 (1935)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	January 31, 1977	January 31, 1976	Reference period 1904–76		
			January average, 1904–76	January maximum (year)	January minimum (year)
Elevation in feet above mean sea level:	4,200.50	4,200.80	4,198.1	4,204.4 (1924)	4,191.90 (1964)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

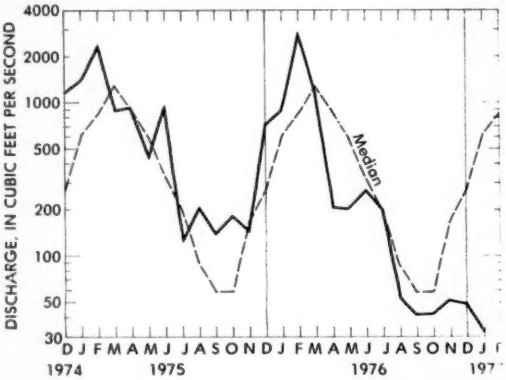
Alltime high (1827–1975): 102.1 (1869). Alltime low (1939–1975): 92.17 (1941).	January 28, 1977	January 31, 1976	Reference period 1939–75		
			January average, 1939–75	January max. daily (year)	January min. daily (year)
Elevation in feet above mean sea level:	95.36	96.51	95.27	98.37 (1974)	93.56 (1948)

FLORIDA

Site	January 1977		December 1976	January 1976
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	760	95	705	664
Miami Canal at Miami (southeastern Florida)	236	130	216	135
Tamiami Canal outlets, 40-mile bend to Monroe	32	94	35	12.0

(Continued from page 4.)
below the normal range; most reported streams were affected by backwater from ice. The January monthly mean flow of 261 cfs at Maumee River at Waterville (drainage area, 6,330 square miles) was lowest in 53 years of record and only 6 percent of the median.

Similarly, in Indiana, streamflow decreased contraseasonally and remained below the normal range. The monthly mean flow of 32 cfs at the index station, Mississinewa River at Marion, was only 5 percent of the January median and below the normal range for the 3d consecutive month. (See graph.)



Monthly mean discharge at Mississinewa River at Marion, Ind. (Drainage area, 682 sq mi, 1,766 sq km)

Also in Illinois, monthly mean flows at all index stations decreased contraseasonally and were below the normal range. The January monthly mean discharge of 3.76 cfs in Sangamon River at Monticello (drainage area, 550 square miles) was only 2 percent of the median and lowest in 66 years of record.

Ground-water levels in shallow water-table wells in Minnesota declined and continued below average. The level in the key well near Hanska in Brown County, south-central Minnesota, was the lowest for January in 33 years of record—the fourth consecutive new monthly low in this well. In the Minneapolis-St. Paul area, artesian pressures in wells tapping the Prairie du Chien-Jordan aquifer remained unchanged and rose slightly in the deeper Mt. Simon-Hinckley aquifer; both were below average. In Wisconsin, levels declined seasonally and were near or slightly below average. In Michigan, levels declined in most areas; levels were generally below average, and some record lows occurred in the western part of the Upper Peninsula. In Illinois, the shallow index well in glacial drift at Princeton, in the northwestern part of the State, continued its decline with an abrupt drop of 3 feet, reaching the lowest level since November 1966. Levels in Indiana continued their seasonal decline, aggravated by the subfreezing weather; some residential wells were reported to have gone dry in the western part of the State. Water levels declined in central Ohio more than 2 feet, but only about 1/2 foot in the northeastern part; in both regions they were below average.

MIDCONTINENT

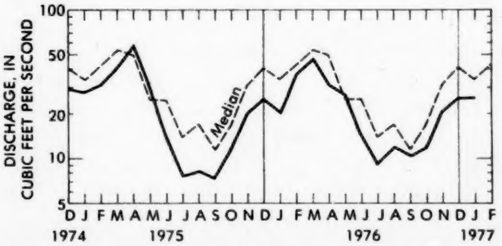
[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow generally decreased in the northern and central parts of the region and increased in the southern part. Flows remained in the below-normal range in all, or parts, of Arkansas, Iowa, Kansas, Missouri, Nebraska, North Dakota, and South Dakota, and decreased into that range in southern Saskatchewan. Flows were lowest of record for January in parts of Iowa, Nebraska, and South Dakota. At monthend, an ice jam extending from Plattsmouth, Nebraska to Atchison, Kansas represented a serious flood potential.

In central Iowa, the monthly mean discharge of 32 cfs, and the daily mean of 26 cfs on the 31st, in Des Moines River below Raccoon River at Des Moines (drainage area, 9,879 square miles) were lowest for January in record that began in April 1940. Upstream, at Fort Dodge, the monthly mean discharge was 36 cfs, only 2.5 cfs greater than the January minimum monthly mean in 45 years of record. In the northeastern part of the State, flow of Cedar River at Cedar Rapids decreased sharply to 35 percent of median and remained in the below-normal range for the 3d consecutive month. The monthly mean discharge of 319 cfs was only 20 cfs greater than the January minimum monthly mean in 75 years of record. In the extreme southwestern part of the State, monthly mean flow of Nishnabotna River above Hamburg decreased contraseasonally, was below the normal range, and only one-half of the January median.

In northeastern Nebraska, the monthly mean discharge of 197 cfs was lowest for the month in 57 years of record at the index station, Elkhorn River at Waterloo (drainage area, 6,900 square miles) and was only 42 percent of median. In the extreme northwestern part of the State, monthly mean flow of Niobrara River above Box Butte Reservoir increased slightly but remained in the below-normal range for the 3d consecutive month. (See graph on page 7.)

In the Big Sioux River basin in eastern South Dakota and the adjacent areas of Minnesota and Iowa, the monthly mean discharge of 12.2 cfs, and the daily mean of 5.0 cfs on the 28th, at the index station at Akron, Iowa (drainage area, 9,030 square miles) were the lowest for January in 49 years of record. In the central part of the State, flow at the index station, Bad River near Fort Pierre, ceased on June 7, 1976 and had not resumed at the end of January. Median flow for January at the site is 0 cfs.



Monthly mean discharge of Niobrara River above Box Butte Reservoir, Nebr. (Drainage area, 1,400 sq mi; 3,626 sq km)

In southwestern North Dakota, monthly mean flow of Cannonball River at Breien decreased sharply, as a result of extremely low temperatures, and was about one-fourth of the January median flow. Only a few streams in the State were flowing at monthend. In the northwestern part of the State, the monthend level of Lake Sakakawea, mainstem reservoir on Missouri River, was the lowest since 1969. In the eastern part of the State, monthly mean discharge of Red River of the North at Grand Forks increased slightly but remained in the below-normal range for the 5th consecutive month and was about one-fourth of median flow for the month.

In Manitoba, monthly mean discharge in Waterhen River below Waterhen Lake continued to decrease seasonally and was less than median for the 2d consecutive month. The level of Lake Winnipeg at Gimli averaged 711.71 feet above mean sea level for the month, 1.36 feet below the long-term mean, and 0.16 foot lower than the average level last month.

In southern Saskatchewan, monthly mean flow of Qu'Appelle River near Lumsden decreased seasonally, was in the below-normal range, and was about one-half of the January median.

In Kansas, monthly mean flows decreased and were below the normal range at all index stations. In the northwestern part of the State, monthly mean discharge of Saline River near Russell decreased sharply, remained below the normal range, and was one-fourth of median flow for the month. In southwestern Kansas, monthly mean discharge of Arkansas River at Arkansas City continued to decrease seasonally, and remained below the normal range for the 6th consecutive month. In the north-central part of the State, monthly mean flow in Little Blue River near Barnes decreased into the below-normal range. Flow at this site has been less than median in 11 of the past 12 months.

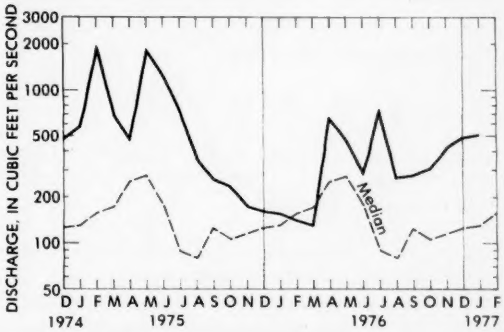
In northwestern Missouri, monthly mean flow of Grand River near Gallatin increased seasonally but was only 16 percent of median, and remained below the normal range for the 3d consecutive month. In the south-central part of the State, monthly mean discharge of Gasconade River at Jerome decreased contraseasonally and remained in the below-normal range for the 6th consecutive month.

In southwestern Oklahoma, monthly mean discharge at the index station, Washita River near Durwood, increased seasonally, as a result of increased runoff near midmonth, but remained below median for the 9th consecutive month.

In northern Arkansas, monthly mean flow in Buffalo River near St. Joe decreased contraseasonally, was below the normal range, and only 15 percent of the January median. In the southern part of the State, flow in Saline River near Rye increased seasonally and monthly mean discharge remained in the normal range for the 6th consecutive month.

In Louisiana, flows increased seasonally throughout the State and monthly mean discharges were near or slightly greater than median.

In south-central Texas, monthly mean flow in Guadalupe River near Spring Branch increased seasonally and remained in the above-normal range for the 3d consecutive month. (See graph.) In the Panhandle area and upper Red River basin, flows were below the normal range, and in the western, central, and eastern parts of the State, monthly mean flows were normal.



Monthly mean discharge of Guadalupe River near Spring Branch, Tex. (Drainage area, 1,315 sq mi; 3,406 sq km)

Ground-water levels in North Dakota declined slightly and remained at or near record lows; a new all-time low was reached in the index well at Wyndmere. Levels in Nebraska rose slightly in three of the four principal water-table index wells, but all ranged from 0.05 to 1.95 feet below average for January and below the levels of a year ago. Levels in Iowa continued to decline in most parts of the State; they were well below average in the northern two-thirds of the State. An all-time low was reached for the fourth consecutive month in the shallow index well at Marion, in Linn County in east-central Iowa. Levels in the southern part of the State were slightly above average. In the northwest Kansas High Plains, levels in the Colby area indicated a new low for January, despite a slight rise of less than half a foot since

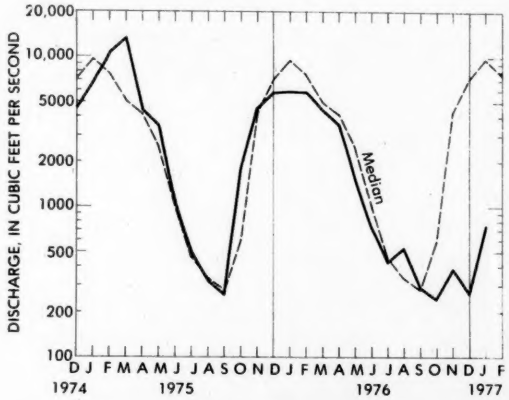
end-December. In the rice-growing area of east-central Arkansas, the level in the shallow aquifer rose slightly but was in the same range that has prevailed since 1955. In the industrial aquifer of central and south Arkansas—the Sparta Sand—the level in the key well at Pine Bluff declined slightly, but was 11.7 feet below average and 0.7 foot lower than a year ago. At El Dorado, in the same aquifer, the level declined nearly 3 feet, but was 24 feet higher than in January 1966—the lowest January level in 21 years of record. Levels declined in nearly all the major aquifers in Louisiana. Lower levels occurred in key wells in the Sparta Sand in the northern part of the State. Levels declined also in the Miocene and Pleistocene aquifers of central Louisiana, in the "2,000-foot sand" of the Baton Rouge area and in the Chicot aquifer of southwestern Louisiana. Levels rose in the 400-, 600-, 1,200-, and 1,500-foot sands of the Baton Rouge area, and in the 700-foot sand in New Orleans. In Texas, levels in index wells were above average in the Edwards Limestone at Austin and San Antonio, but below average in the bolson deposits at El Paso. Levels rose at Austin, San Antonio, and El Paso; a new January high was reached in San Antonio. A new all-time low was noted in the Ogallala Formation at Plainview.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow increased seasonally in Arizona and parts of California and Oregon, but generally decreased elsewhere in the region. Flows remained below the normal range in parts of each State and were lowest of record in parts of California, Colorado, New Mexico, Oregon, Utah, and Washington. Drought conditions persisted in many parts of the region and monthend snowpack was reported to be far below normal. Water-use restrictions were in effect in a few communities in California where water-supply reservoir storage was low.

Streamflow increased slightly at all index stations in California but remained in the below-normal range, and was lowest of record at some stations. For example, in the central part of the Sierra Nevada west slope, the monthly mean discharge of 63.2 cfs, and the daily mean of 36 cfs on the 1st, at the index station, North Fork American River at North Fork Dam (drainage area, 342 square miles) were lowest for the month in 36 years of record. Similarly, on the east slope of the central Sierra Nevada, the monthly mean flow of 18.1 cfs, and the daily mean of 14 cfs on the 8th, in West Walker River below Little Walker River, at Coleville (drainage area, 180 square miles) were lowest for January in 39 years of record. In the extreme north-coastal basin of Smith River, the monthly mean discharge of 760 cfs, and the daily mean of 279 cfs on the 1st, at the index station near Crescent City (drainage area, 609 square miles) were lowest for the month in 67 years of record. That monthly mean discharge was only 8 percent of the January median. (See graph.) This was the 2d con-



Monthly mean discharge of Smith River near Crescent City, Calif. (Drainage area, 609 sq mi; 1,577 sq km)

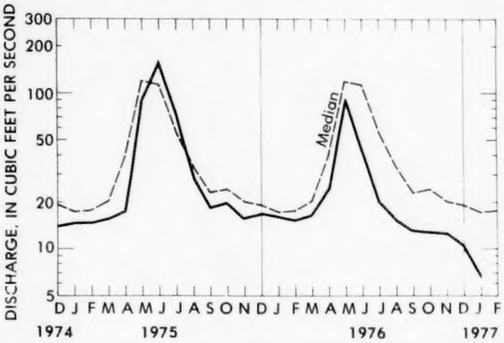
secutive month in which flows have been near or below the previously recorded minimums at these three sites and was indicative of the persistence of drought conditions in northern and central California. Contents of major reservoirs in northern California were 60 percent of average and 56 percent of that of a year ago at monthend. Water-use restrictions are intended to reduce the rate of drawdown in these reservoirs.

In Oregon, flows generally increased seasonally, except in Willamette River at Salem, but remained below the normal range for the 4th consecutive month at some index stations, reflecting the persistence of drought conditions. In the south-coastal basin of Umpqua River, the monthly mean discharge of 1,522 cfs at the index station near Elkton (drainage area, 3,683 square miles) was the lowest for January in 72 years of record, and only 8 percent of median. In the north-coastal basin of Wilson River, the monthly mean flow of 363 cfs at the index station near Tillamook (drainage area, 161 square miles) was 16 percent of median and lowest for the month in 47 years of record. This was the 2d consecutive month that monthly mean discharges at those two sites have been lowest of record, and is indicative of the severity of drought conditions in those areas. In eastern Oregon, monthly mean flow in John Day River at Service Creek increased slightly but was only 30 percent of median and in the below-normal range for the 3d consecutive month.

In Washington, flows decreased contraseasonally and remained below the normal range for the 3d consecutive month, except in the northern part of the State where flows were normal. In the south-coastal basin of Chehalis River, the monthly mean discharge of 881 cfs at the index station near Grand Mound (drainage area, 895 square miles) was lowest for the month in 49 years of record. In the eastern part of the State, monthly mean flow in Spokane River at Spokane decreased contraseasonally, was about one-third of median for the month, and was below the normal range for the 3d consecutive month.

In Alberta, monthly mean flows decreased seasonally and were below the normal range in Bow River at Banff, but were in the normal range in Athabasca River at Hinton. In British Columbia, monthly mean discharge decreased seasonally in Fraser River at Hope but was above the normal range.

In Utah, streamflow decreased seasonally except in the southeastern part of the State, where monthly mean discharge of San Juan River near Bluff increased contraseasonally but remained below the normal range for the 7th consecutive month. In Beaver River basin in southwestern Utah, the monthly mean discharge of 6.76 cfs, and the daily mean of 4.2 cfs on the 3d, at the index station near Beaver (drainage area, 90.7 square miles) were lowest for January in 63 years of record. This was the 3d consecutive month of record-low monthly mean discharges at this site and reflects the drought conditions existing in that area. (See graph.) In the northeastern



Monthly mean discharge of Beaver River near Beaver, Utah
(Drainage area, 90.7 sq mi; 235 sq km)

part of the State, the monthly mean flow of 36.1 cfs in Weber River near Oakley (drainage area, 163 square miles) was lowest for January in 73 years of record, and was in the below-normal range for the 5th consecutive month. Also in northeastern Utah, monthly mean discharge in Whiterocks River near Whiterocks decreased seasonally and remained below the normal range for the 4th consecutive month.

In south-central Colorado, in the Arkansas River basin, the monthly mean discharge of 236 cfs at the index station at Canon City (drainage area, 3,117 square miles) was lowest for January in 89 years of record, and was below the normal range for the 2d consecutive month. West of the Continental Divide, monthly mean flow in Animas River at Durango continued to decrease seasonally and remained below the normal range for the 3d consecutive month. Also west of the Divide, in Yampa River basin, the monthly mean flow at Steamboat Springs increased contraseasonally but remained in the below-normal range for the 3d consecutive month.

In east-central New Mexico, monthly mean flow in Pecos River at Santa Rosa (drainage area, 2,650 square miles) decreased seasonally and remained below the normal range for the 4th consecutive month, and the daily mean discharge of 3.7 cfs on the 19th was lowest for January in 63 years of record. In the northern part of the State, monthly mean flows decreased seasonally in Rayado Creek at Sauble Ranch, near Cimarron and Rio Grande below Taos Junction Bridge, near Taos, and were in the below-normal range.

In the northwestern part of Arizona and adjacent area of Utah, monthly mean flow in Virgin River, as measured at Littlefield, Arizona, increased contraseasonally but remained below the normal range for the 3d consecutive month. Elsewhere in the State, monthly mean flows increased seasonally and were in the normal range.

In western Montana and southern Wyoming monthly mean flows decreased seasonally and were below the normal range. West of the Continental Divide, in western Montana, monthly mean discharge in Middle Fork Flathead River near West Glacier remained in the below-normal range for the 4th consecutive month, and the daily mean discharge of 190 cfs on the 3d was lowest for January in 38 years of record and the 2d lowest for any month in that period. The cumulative runoff at this station during the period, October through January, was 48 percent of median. Also on the west slope, monthly mean flow of Clark Fork at St. Regis decreased and was in the below-normal range for the first time in 21 months. East of the Divide, flows were in the normal range. In northern Wyoming, monthly mean discharge in Tongue River near Dayton remained in the normal range for the 5th consecutive month.

Monthend storage in major reservoirs in northern California was about 60 percent of average. In the major reservoirs in the Colorado-Big Thompson Project, in northern Colorado, monthend storage also was below normal. In eastern Idaho, storage was near normal but in reservoirs in the western and northern parts of the State, storage at monthend was below normal. Contents of the Colorado River Storage Project decreased 648,600 acre-feet during the month.

Ground-water levels in eastern Washington continued to decline during January; the level in the key well in Spokane Valley was more than 2½ feet below average. The level in the well in northern Puget Trough in the western part of the State rose slightly but continued more than 2 feet below average. In Idaho, the level in the well penetrating the sand and gravel aquifer in the Boise Valley continued its seasonal decline and was slightly below average. Levels in the key wells representative of the Snake River Plain aquifer declined; all were below average except in the southwestern area, near Eden where the level was above average. The level in the alluvial aquifer of the Rathdrum Prairie in northern Idaho continued its decline and was slightly below average for the first time since October 1976. In Montana, the level in the well in terrace gravel near Missoula continued its decline but was slightly above average at month's end. In southern California, the artesian pressure in the observation well in the Los Alamitos area in Orange County rose more than 3 feet, but was nearly 19 feet below average and 2 feet below the level of a year ago. Among the water-table wells, the well in Baldwin Park rose about half a foot, but continued more than 60 feet below average. The levels in the two wells in Santa Barbara County fell less than a foot but continued below average—more than 16 feet at Cuyama, and nearly 8 feet below average at Santa Maria. In Nevada, the levels in the key wells in Paradise Valley and at Steptoe rose slightly, with a new record high for January at Steptoe. The level fell with a new alltime low in the well in Truckee Meadows. In Utah, levels in artesian wells in the Holladay and Flowell areas rose but continued below-average; despite the rise of nearly 2 feet in the Holladay well, the level was at a new low for January. Pressure levels continued to decline, but remained above average, in the Logan and Blanding areas. In Arizona, levels rose in all five index wells during the month; even so, new January lows were recorded at the Tucson and Elfrida wells. In New Mexico, fluctuations varied among the water-table wells; all continued below average. The level in the well in the Roswell Artesian Basin in Pecos Valley declined more than 2 feet, reaching a new January low.

ALASKA

Streamflow at the index station, Gold Creek near Juneau, continued its seasonal decline and was within the normal range at 171 percent of median as a result of above-normal rainfall. However, streamflow in south-central Alaska was above the normal range for those streams draining the lower elevations and within the normal range for streams draining the higher elevations. Abnormally warm temperatures occurred during January with some rain in the lowlands. At the index station on the Kenai Peninsula, Kenai River at Cooper Landing (drainage area, 634 square miles), the monthly mean discharge of 1,636 cfs was highest for January in 29 years of record. In contrast, within interior Alaska, streamflow at the index station, Chena River at Fairbanks, and at the large river station, Tanana River at Nenana, was below the normal range and record low for the 2d consecutive month at those stations.

Ground-water levels in deep wells in the Anchorage area rose 1 to 2 feet above levels of last month near the Chugach Mountain front and dropped a comparable amount elsewhere in the area. Shallow water table wells at the end of January were unchanged from a month ago.

HAWAII

Streamflow continued to decrease and was below the normal range in all parts of the State. Flows were lowest of record for January at index stations on the islands of Kauai, Maui, and Oahu. Monthly mean flows on Kauai and Oahu have been in the below-normal range for the past 3 months, reflecting the persistence of drought conditions on those islands. In East Branch of North Fork Wailua River near Lihue, Kauai (drainage area, 6.27 square miles), the monthly mean discharge of 16.1 cfs was lowest for January in 62 years of record. At Honopou Stream near Huelo (drainage area, 0.64 square miles), on the island of Maui, the monthly mean discharge of 0.59 cfs, and the daily mean of 0.38 cfs on the 22d, 23d, and 24th, were lowest for January in 66 years of record. At Kalihi Stream near Honolulu (drainage area, 2.61 square miles), on the island of Oahu, the monthly mean of 0.54 cfs, and the daily mean of 0.24 cfs on the 22d, 23d, and 24th, were lowest for the month in 63 years of record. Monthly and daily mean flows in December also were lowest of record at this station. On the island of Hawaii, monthly mean discharge decreased sharply and was in the below-normal range for the first time since October, 1976. At the summit of Mount Waialeale, on the island of Kauai, known as the wettest spot on earth, where average annual rainfall is reported to be about 450 inches, precipitation during recent months has been reported to be far below normal. Also, the mountain peak, where rain falls about 350 days each year and which normally is obscured by thick cloud cover, reportedly has been visible on numerous days recently.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JANUARY 1977

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of Dec. 1976	End of Jan. 1977	End of Jan. 1976	Average for end of Jan.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	51	69	77	55	226,300 (a)
QUEBEC					
Allard (P)	76	54	66	68	280,600 ac-ft
Gouin (P)	75	65	73	87	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	81	63	49	48	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	62	35	41	37	3,330 mcf
Lake Francis (FPR)	65	49	51	51	4,326 mcf
Lake Winnipesaukee (PR)	76	64	62	56	7,200 mcf
VERMONT					
Harriman (P)	60	49	15	46	5,060 mcf
Somerset (P)	68	55	79	59	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	70	67	77	70	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	53	42	38	44	34,270 mcf
Indian Lake (FMP)	71	47	59	53	4,500 mcf
New York City reservoir system (MW)	89	84	88	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	84	76	100	76	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	23	15	39	25	51,400 mcf
Pymatuning (FMR)	71	70	84	83	8,191 mcf
Raystown Lake (FR)	62	61	67	36	33,190 mcf
Lake Wallenpaupack (PR)	66	44	66	51	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	96	93	100	86	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	80	67	82	78	12,580 mcf
Narrows (Badin Lake) (P)	99	97	91	96	5,617 mcf
High Rock Lake (P)	72	50	56	69	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	82	78	78	62	70,300 mcf
Lakes Marion and Moultrie (P)	104	89	61	67	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	64	71	69	57	75,360 mcf
GEORGIA					
Burton (PR)	64	55	67	55	104,000 ac-ft
Sinclair (MPR)	86	74	86	80	214,000 ac-ft
Lake Sidney Lanier (FMPR)	56	61	65	53	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	74	70	85	67	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	35	29	38	33	1,156,000 cfsd
Douglas Lake (FPR)	11	10	20	13	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	41	41	51	41	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	41	31	40	32	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	36	30	45	39	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	57	52	68	41	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	15	9	50	32	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	10	11	17	21	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	83	81	86	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	62	63	64	74	127,600 ac-ft
Bell Fourche (I)	25	31	51	48	185,200 ac-ft
Lake Francis Case (FIP)	55	68	64	65	4,834,000 ac-ft
Lake Oahe (FIP)	80	81	82	.....	22,530,000 ac-ft
MIDCONTINENT REGION—Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	103	103	104	94	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	99	95	96	93	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	70	71	77	72	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	65	67	79	84	2,378,000 ac-ft
Keystone (FPR)	65	62	79	90	661,000 ac-ft
Tenkiller Ferry (FPR)	74	69	102	89	628,200 ac-ft
Lake Altus (FIMR)	55	55	94	48	134,500 ac-ft
Lake O'The Cherokees (FPR)	70	68	73	78	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	83	79	86	87	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	91	92	87	42	386,400 ac-ft
Canyon (FMR)	99	98	93	67	385,600 ac-ft
International Amistad (FIMPW)	107	107	100	74	3,497,000 ac-ft
International Falcon (FIMPW)	100	100	94	73	2,667,000 ac-ft
Livingston (IMW)	100	100	100	70	1,788,000 ac-ft
Possum Kingdom (IMPRW)	92	89	91	97	569,400 ac-ft
Red Bluff (PI)	21	22	35	31	307,000 ac-ft
Toledo Bend (P)	86	87	90	78	4,472,000 ac-ft
Twin Buttes (FIM)	99	100	99	17	177,800 ac-ft
Lake Kemp (IMW)	77	78	82	88	268,000 ac-ft
Lake Meredith (FMW)	39	39	43	38	821,300 ac-ft
Lake Travis (FIMPRW)	98	99	93	79	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	67	40	83	54	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	96	81	97	76	5,232,000 ac-ft
Lake Chelan (PR)	51	38	76	59	676,100 ac-ft
Lake Cushman	68	53	94	84	359,500 ac-ft
Lake Merwin (P)	88	92	96	96	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	60	63	66	64	1,235,000 ac-ft
Coeur d'Alene Lake (P)	29	16	73	50	238,500 ac-ft
Pend Oreille Lake (FP)	35	40	59	55	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	65	70	65	67	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	81	72	72	69	802,000 ac-ft
Buffalo Bill (IP)	59	53	64	65	421,300 ac-ft
Keyhole (F)	66	66	67	39	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	57	57	64	45	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	1	4	2	16	364,400 ac-ft
Taylor Park (IR)	59	56	60	55	106,200 ac-ft
Colorado–Big Thompson project (I)	49	48	69	57	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	75	72	80	.....	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	75	73	76	56	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	32	30	53	53	1,000,000 ac-ft
Hetch Hetchy (MP)	16	10	36	30	360,400 ac-ft
Isabella (FIR)	12	12	31	24	551,800 ac-ft
Pine Flat (FI)	25	26	47	50	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	50	48	75	81	2,438,000 ac-ft
Lake Almanor (P)	56	58	64	46	1,036,000 ac-ft
Lake Berryessa (FIMW)	75	62	85	84	1,600,000 ac-ft
Millerton Lake (FI)	48	50	71	64	503,200 ac-ft
Shasta Lake (FIPR)	37	36	68	89	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	25	23	67	52	744,600 ac-ft
NEVADA					
Rye Patch (I)	64	66	98	.....	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	82	85	78	65	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	0	1	11	15	1,073,000 ac-ft
Salt and Verde River system (IMPR)	45	48	50	39	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	23	24	24	75	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	17	18	30	28	2,539,000 ac-ft

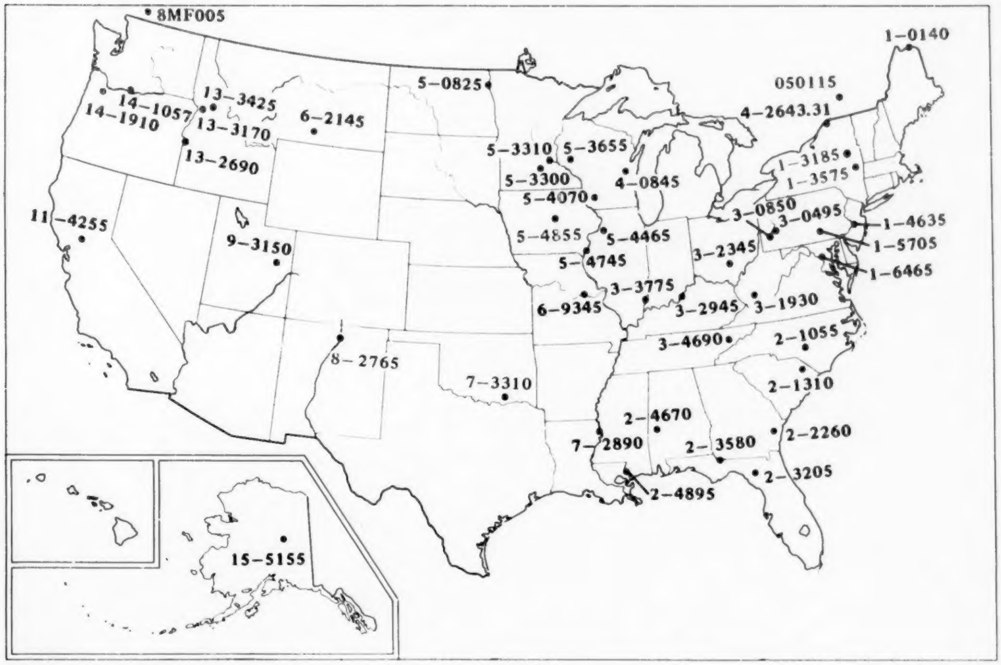
[a] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

FLOW OF LARGE RIVERS DURING JANUARY 1977

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	January 1977: Monthly discharge (cfs)	January 1977: Percent of median monthly discharge, 1941–70	January 1977: Change in discharge from previous month (percent)	Discharge near end of month: (cfs)	Discharge near end of month: (mgd)	Discharge near end of month: Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	1,647	59	-63	1,250	810	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	1,430	81	-36	1,400	900	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	2,490	55	-53	....	....	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	5,455	53	-34	5,000	3,200	25
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	9,797	32	-55	9,000	5,800	31
1–6465	Potomac River near Washington, D.C.	11,560	[1] 10,640	4,520	39	-57	4,550	2,940	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	7,662	146	+1	3,650	2,360	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	16,600	167	-22	8,820	5,700	27
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	34,950	244	+5	35,100	22,700	27
2–3205	Suwannee River at Branford, Fla	7,740	6,775	20,500	491	+21	18,600	12,000	31
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	40,850	160	-2	22,000	14,200	31
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	42,900	148	+117	34,900	22,600	28
2–4895	Pearl River near Bogalusa, La	6,630	8,533	20,280	251	+264	12,700	8,210	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 18,700	5,746	26	-60	5,740	3,710	26
3–0850	Monongahela River at Braddock, Pa.	7,337	[1] 11,950	4,234	25	-65	3,400	2,200	26
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	5,967	38	-56	4,720	3,050	26
3–2345	Scioto River at Higby, Ohio	5,131	4,337	670	18	-35	648	419	26
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	41,000	28	-50	41,800	27,000	29
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	2,738	12	-28	2,750	1,780	31
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1] 6,528	6,375	80	-7	....	....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	1,430	41	-33	....	....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	222,600	100	-7	225,000	145,000	31
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	4,210	50	-42	20,000	13,000	30
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	215	27	+4	215	139	31
5–3300	Minnesota River near Jordan, Minn	16,200	3,306	152	31	-3	140	90	27
5–3310	Mississippi River at St. Paul, Minn	36,800	[1] 10,230	1,520	34	+3	1,580	1,020	26
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	1,233	45	+2	....	....	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	3,771	67	+33	....	....	.....
5–4465	Rock River near Joslin, Ill	9,520	5,288	1,450	42	-49	1,400	900	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	61,210	17,300	52	+7	17,500	11,300	31
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	32	6	-71	26	17	31
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	2,748	107	-21	2,500	1,600	31
6–9345	Missouri River at Hermann, Mo	528,200	78,480	24,950	76	-31	21,000	13,600	26
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552,700	275,500	51	-4	318,000	206,000	31
7–3310	Washita River near Durwood, Okla	7,202	1,379	299	66	+15	370	240	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	732	303	66	-2	300	190	24
9–3150	Green River at Green River, Utah	40,600	6,369	1,714	94	0	4,510	2,910	31
11–4255	Sacramento River at Verona, Calif	21,257	18,370	8,944	35	+43	9,350	6,040	28
13–2690	Snake River at Weiser, Idaho	69,200	17,670	14,950	100	-10	15,400	9,950	28
13–3170	Salmon River at White Bird, Idaho	13,550	11,060	3,304	79	-24	3,430	2,220	28
13–3425	Clearwater River at Spalding, Idaho	9,570	15,320	2,336	36	-16	11,500	7,400	28
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	143,400	128	+10	....	....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	6,389	12	-4	5,414	3,500	27–31
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	4,387	67	-10	4,300	2,780	31
8MF005	Fraser River at Hope, British Columbia.	83,800	95,300	44,900	131	-14	44,300	28,600	28

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge (unadjusted) determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

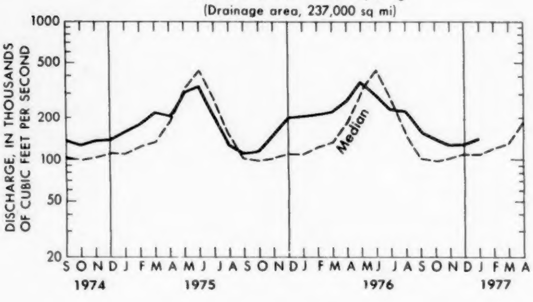
SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



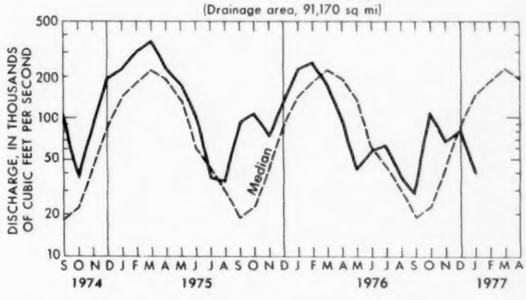
Location of stream-gaging stations on large rivers listed in table on page 12.

HYDROGRAPHS OF FOUR LARGE RIVERS

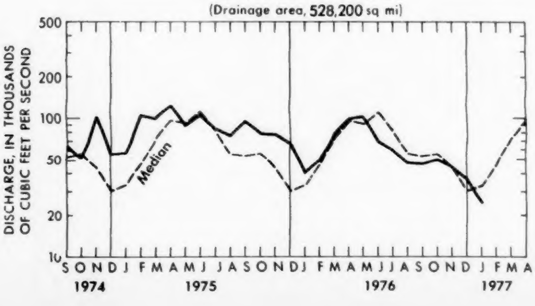
Columbia River at The Dalles, Oreg.
(Drainage area, 237,000 sq mi)



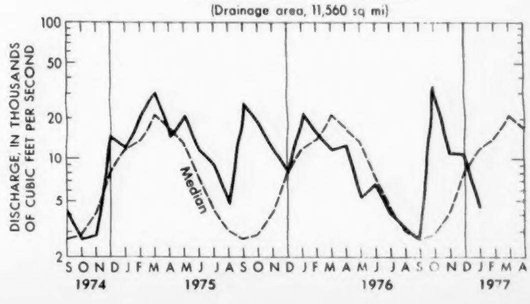
Ohio River at Louisville, Ky.
(Drainage area, 91,170 sq mi)



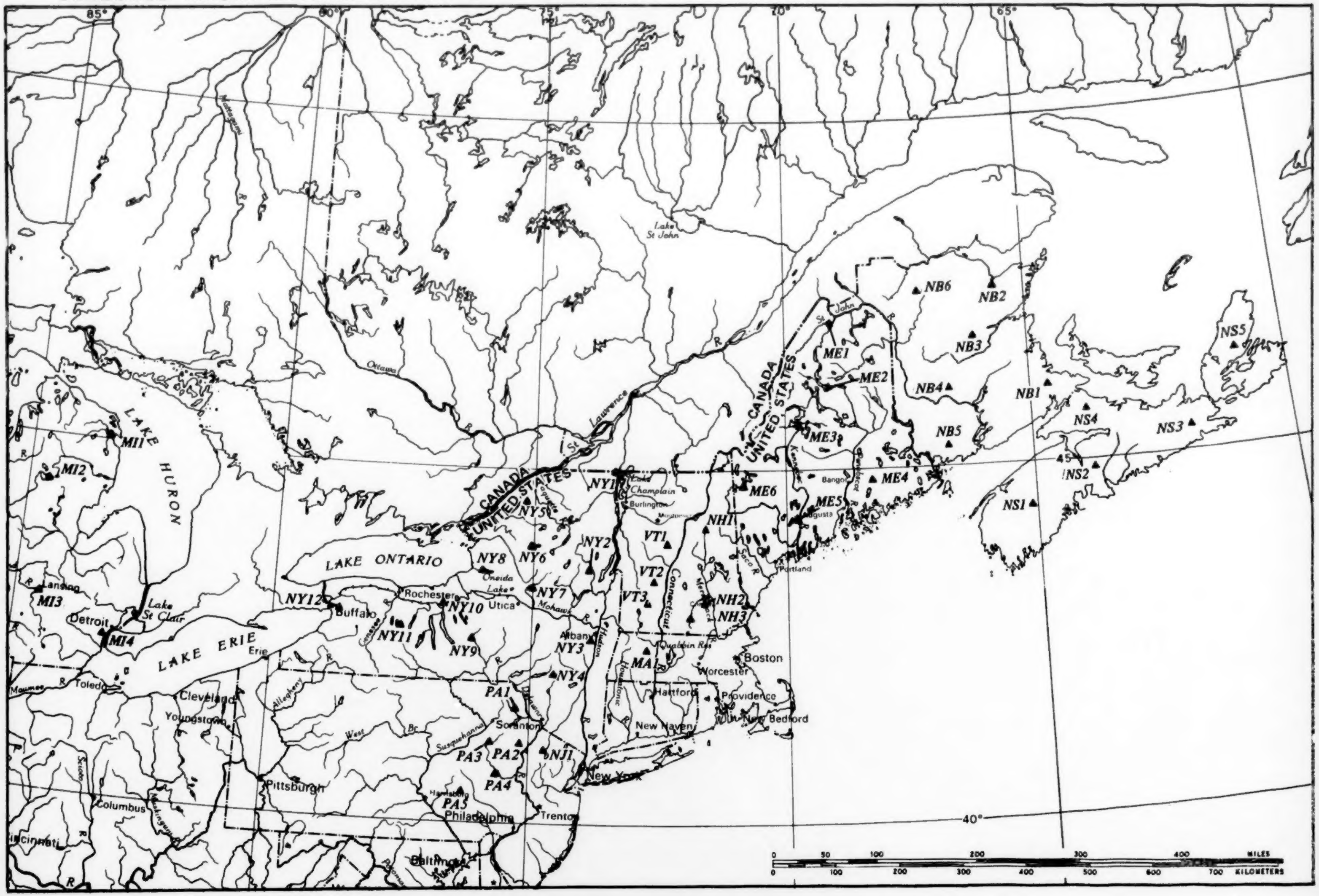
Missouri River at Hermann, Mo.
(Drainage area, 528,200 sq mi)



Potomac River near Washington, D.C.
(Drainage area, 11,560 sq mi)



SELECTED SNOW SURVEY COURSES IN NORTHEASTERN UNITED STATES AND SOUTHEASTERN CANADA



Location of snow survey courses listed in table on page 13.

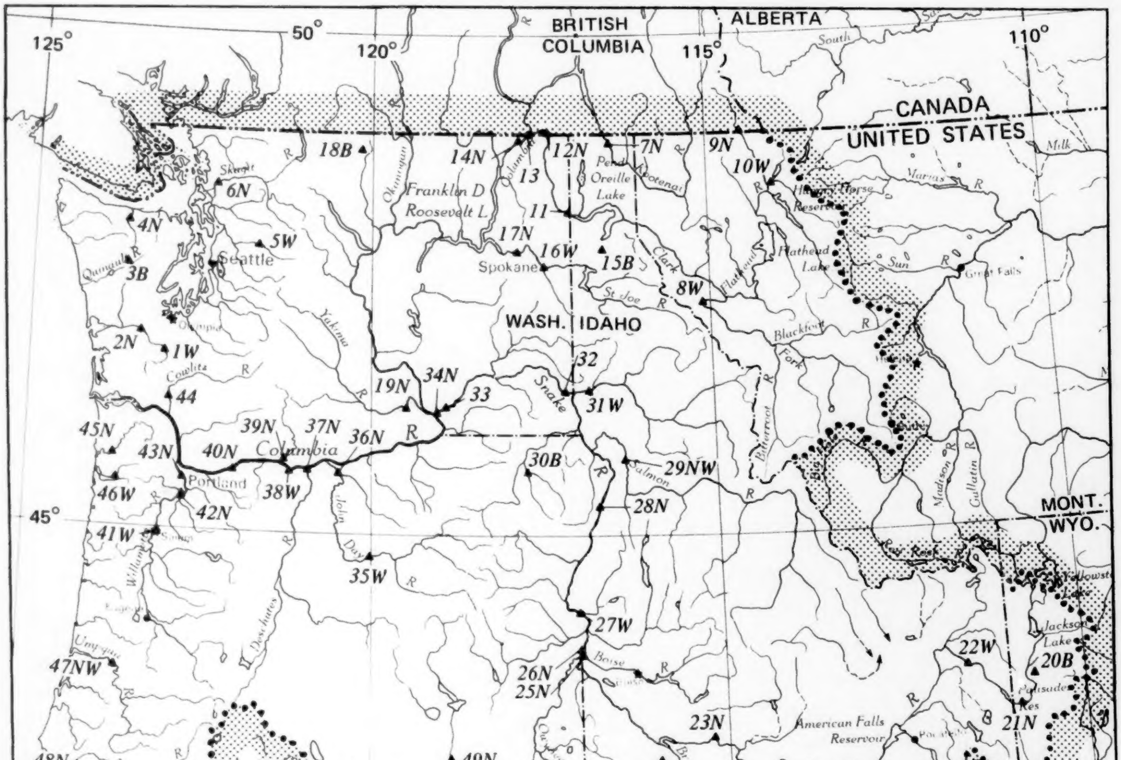
SNOW SURVEY DATA

Map number	Snow course	River basin	Location: Elev. above MSL	Location: Latitude	Location: Longitude	This season: Date of survey	This season: Snow depth (inches)	This season: Water content (inches)	Past seasons, Water content: Average	Past seasons, Water content: Years of record	Agency providing data
NS1	Caledonia	Medway	300	44°25′	65°03′	1/21	10.9	1.1	......	22	WSC*
NS2	Mount Uniacke		500	44°53′	63°50′	1/11	5.8	0.7	......	30	...do...........
NS3	Copper Lake	South	320	45°23′	61°57′	1/18	8.7	0.8	......	17	...do...........
NS4	Oxford	Philip	120	45°43′	63°51′	1/24	12.7	3.0	......	17	...do...........
NS5	Margaree Valley	Northeast Margaree	150	46°21′	60°58′	1/26	5.5	2.0	......	19	...do...........
NB1	Moncton	Petitcodiac	150	46°04′	64°36′	1/11	20.0	3.4	......	22	...do...........
NB2	Pabineau Falls	Nipisiguit	100	47°30′	65°41′	1/12	24.9	4.6	......	17	...do...........
NB3	Littleton	Miramichi	75	46°56′	65°55′	1/20	24.0	3.7	......	23	...do...........
NB4	Royal Road	N. Nashwaaksis	427	46°04′	66°43′	1/31	19.1	4.1	4.0	11	NBDOE*
NB5	Elmcroft	Magaguadavic	300	45°16′	66°49′	1/26	18.9	3.5	......	25	WSC*
NB6	St. Quentin No. 1	Restigouche	1,200	47°30′	67°15′	1/31	46.8	11.0	5.0	18	NBEPC*
ME1	Alagash "B"	St. John	640	47°05′	69°04′	1/28	31.4	7.3	......	.....	USGS
ME2	Telos	Penobscot	1,000	46°09′	69°07′	1/30	32.8	5.9	......	.....	Bangor Hydro Electric Co.
ME3	Moosehead	Kennebec	1,040	45°35′	69°43′	2/1	31.3	6.1	......	.....	Kennebec Water Power Co.
ME4	Amherst	Coastal	150	44°49′	68°22′	1/31	23.2	4.5	......	.....	Bangor Hydro Electric Co.
ME5	Augusta	Kennebec	160	44°19′	69°45′	2/1	20.8	5.2	......	.....	USGS
ME6	Middle Dam	Androscoggin	1,430	44°46′	70°55′	1/31	28.0	5.2	......	.....	Union Water Power Co.
NH1	Cannon Mt. (Base)	Merrimack	1,950	44°10′	71°41′	1/31	33.8	8.4	......	.....	U.S. Corps of Engineers
NH2	Everett Dam	...do........	460	43°05′	71°39′	1/31	23.6	4.9	......	.....	...do...........
NH3	MacDowell Dam	...do........	960	42°54′	71°59′	1/31	19.5	4.1	......	.....	...do...........
VT1	Vershire	Connecticut	1,920	43°59′	72°22′	1/31	22.0	5.5	......	.....	...do...........
VT2	Proctorsville Gulf	...do........	1,060	43°22′	72°38′	1/31	17.8	3.8	......	.....	...do...........
VT3	Ball Mt. Dam	...do........	1,130	43°06′	72°48′	1/31	20.0	3.6	......	.....	...do...........
MA1	Lithia Post Office	Connecticut	1,180	42°27′	72°50′	1/31	13.0	2.5	......	.....	...do...........
NY1	Perry Mills	Lake Champlain	200	44°59′	73°31′	2/2	17.2	3.2	2.52	30	USGS
NY2	Sodom	Hudson	1,400	43°37′	73°59′	1/31	18.4	3.34	3.89	25	NMP-Albany*
NY3	Slingerlands	...do........	230	42°38′	73°53′	1/31	9.6	1.69	1.44	18	USGS
NY4	Margaretville	Delaware	1,340	42°09′	74°38′	2/2	11.0	1.20	1.24	27	...do...........
NY5	Pyrites	St. Lawrence	400	44°32′	75°11′	1/31	22.5	3.8	2.23	30	...do...........
NY6	Stillwater Reservoir	Black	1,700	43°54′	75°03′	2/1	44.5	8.11	4.77	33	BRRD*
NY7	Northwood	Mohawk	1,250	43°21′	75°04′	2/1	32.2	5.00	4.45	32	NMP-Utica*
NY8	Stillwater Dam	Eastern Oswego	970	43°33′	75°55′	....	....	....	4.85	34	NMP-Syracuse*
NY9	Cortland	E. Susquehanna	1,130	42°36′	76°11′	1/25	15.0	2.1	1.20	24	NWS-Albany*
NY10	Clyde (Lock 26)	Western Oswego	392	43°04	76°50′	1/31	13.0	2.52	1.71	15	DOT-Syracuse*
NY11	Canadice and Hemlock Lakes	Genesee	1,800	42°43′	77°35′	2/2	10.3	1.63	1.45	26	Rochester Dept. of Public Works
NY12	Buffalo Airport	Lake Erie	705	42°56′	78°44′	2/1	41	7.40	.87	8	NWS-Buffalo
NJ1	Newton	Pequest	640	41°01′	74°47′	2/1	8.6	1.15	......	.....	USGS
PA1	Prompton-Jadwin Reservoir	Lackawaxen	1,600	41°36′	75°18′	2/1	13.1	2.1	......	.....	Corps of Engineers
PA2	Paradise Valley	Brodhead Creek	840	41°07′	75°16′	1/31	10.1	1.2	......	.....	USGS
PA3	F.E. Walter Reservoir	Lehigh	1,700	41°07′	75°44′	2/1	11.4	1.7	......	.....	Corps of Engineers
PA4	Lyon Valley	Jordan Creek	720	40°40′	75°40′	2/1	8.8	.55	......	.....	USGS
PA5	Meyerstown	Schuylkill	660	40°24′	76°18′	2/2	9.4	1.5	......	.....	...do...........
MI1	Alpena	Thunder Bay	689	45°04′	83°34′	1/31	11	2.7	......	.....	NWS*
MI2	Houghton Lake	Muskegon	1,149	44°22′	84°41′	1/31	11	2.0	......	.....	...do...........
MI3	Lansing	Grand	841	42°47′	84°36′	1/31	10	1.5	......	.....	...do...........
MI4	Detroit	Rouge	633	42°14′	83°20′	1/31	5	0.6	......	.....	...do...........

*Key: WSC Water Survey of Canada; NBDOE New Brunswick Department of Environment; NBEPC New Brunswick Electric Power Commission; BRRD Black River Regulating District; NMP Niagara Mohawk Power; NWS National Weather Service; and DOT Department of Transportation.

PACIFIC NORTHWEST WATER RESOURCES REGION

The Pacific Northwest Region (U.S. part) is region 17 of the 21 water resources regions defined by the U.S. Water Resources Council. The regional boundary is the Pacific Ocean on the west, the United States–Canada international boundary on the north, the Continental Divide on the east, and drainage-basin divides on the south that roughly approximate the southern borders of Oregon and Idaho. Most of the streams in the region drain into the Columbia River which in turn empties into the Pacific Ocean. The region also includes other westwardflowing streams in Washington and Oregon as well as interior-draining streams of Oregon that are part of the Great Basin. Region 17 has a total area of about 271,000 square miles (702,000 sq km), consisting mainly of Washington, most of Oregon and Idaho, and extreme northwestern Montana.



SELECTED DATA FOR SOME KEY STREAM STATIONS IN THE PACIFIC NORTHWEST REGION

The stream stations listed below include, for this region, all sites presently in the National Stream Quality Accounting Network (NASQAN), all Geological Survey hydrologic bench-mark stream-gaging stations; all U.S. (and U.S.–Canada boundary) river stations of the International Hydrological Decade (IHD, 1965–74), and all U.S. index and large-river stations that are used each month in compiling the Water Resources Review. Stations are listed in downstream order, roughly north to south and east to west.

The map number identifies NASQAN sites by "N," the hydrologic bench-mark stations by "B," and Water Resources Review stations by "W." The IHD stations are those with map numbers 2N, 11, 13, 32, 38W, 41W, 44, 47NW, and 48N. Of the 26 NASQAN ("N") stations, radiochemical sampling is carried out at stations 17N, 34N, and 43N; and pesticide sampling at stations 4N, 7N, 14N, 17N, 19N, 21N, 26N, 29NW, 36N, 42N, 45N, and 48N.

Station number, name, and drainage area of 49 sites

Number on map	USGS station number	Site	Drainage area (sq mi)	Average discharge; years of record (cfs)	Within hydrologic cataloging unit–
1W	12027500	Chehalis River near Grand Mound, Wash	895	2,851/47	17100103
2N	12031000	Chehalis River at Porter, Wash	1,294	4,287/20	17100103
3B	12039300	North Fork Quinault River near Amanda Park, Wash	74.1	891/10	17100102
4N	12045500	Elwha River at McDonald Bridge, near Port Angeles, Wash	269	1,512/61	17110020
5W	12134500	Skykomish River near Gold Bar, Wash	535	3,988/47	17110009
6N	12200500	Skagit River near Mount Vernon, Wash	3,093	16,830/35	17110007
7N	12318500	Kootenai River near Copeland, Idaho	13,400	15,740/46	17010104
8W	12354500	Clark Fork at St. Regis, Mont	10,709	7,572/65	17010204
9N	12355000	Flathead River at Flathead, British Columbia (-Mont.)	427	993/24	17010206
10W	12358500	Middle Fork Flathead River near West Glacier, Mont	1,128	2,981/36	17010207
11	12395500	Pend Oreille River at Newport, Wash	24,200	26,080/61	17010216
12N	12398600	Pend Oreille River at international boundary (Wash.)	25,200	...... /63	17010216
13	12399500	Columbia River at international boundary (Wash.)	59,700	100,700/38	17020001
14N	12400520	Columbia River at Northport, Wash	60,200	....	17020001
15B	12416000	Hayden Creek below North Fork, near Hayden Lake, Idaho	22.0	31.0/16	17010305
16W	12422500	Spokane River at Spokane, Wash	4,290	6,924/84	17010305
17N	12433000	Spokane River at Long Lake, Wash	6,020	8,145/36	17010307
18B	12447390	Andrews Creek near Mazama, Wash	22.1	36.2/7	17020008
19N	12510500	Yakima River at Kiona, Wash	5,615	...... /40	17030003
20B	13018300	Cache Creek near Jackson, Wyo	10.6	14.3/13	17040103
21N	13022500	Snake River above reservoir, near Alpine, Wyo	3,465	4,632/23	17040103
22W	13037500	Snake River near Heise, Idaho	5,752	6,943/65	17040104
23N	13154500	Snake River at King Hill, Idaho	35,800	10,760/66	17040212
24B	13169500	Big Jacks Creek near Bruneau, Idaho	253	3.35/20	17050102
25N	13213000	Boise River near Parma, Idaho	3,970	2,233/4	17050114
26N	13213100	Snake River at Nyssa, Oreg	58,700	...... /0	17050115
27W	13269000	Snake River at Weiser, Idaho	69,200	18,170/65	17050115
28N	13290450	Snake River at Hells Canyon Dam, Idaho-Oregon State line	73,300	22,460/10	17050201
29NW	13317000	Salmon River at White Bird, Idaho	13,550	11,290/63	17060209
30B	13331500	Minam River at Minam, Oreg	240	494/11	17060105
31W	13342500	Clearwater River at Spalding, Idaho	9,570	15,570/53	17060306
32	13343500	Snake River near Clarkston, Wash	103,200	[disc.12-31-72]	17060107
33	13353000	Snake River below Ice Harbor Dam, Wash	108,500	...... /14	17060110
34N	13353200	Snake River at Burbank, Wash	108,800	....	17060110
35W	14046500	John Day River at Service Creek, Oreg	5,090	1,837/47	17070204
36N	14048000	John Day River at McDonald Ferry, Oreg	7,580	2,019/70	17070204
37N	14103000	Deschutes River at Moody near Biggs, Oreg	10,500	5,830/71	17070306
38W	14105700	Columbia River at The Dalles, Oreg	237,000	194,600/97	17070105
39N	14113000	Klickitat River near Pitt, Wash	1,297	1,630/49	17070106
40N	14128910	Columbia River at Warrendale, Oreg	240,000	....	17080001
41W	14191000	Willamette River at Salem, Oreg	7,280	23,810/59	17090007
42N	14207500	Tualatin River at West Linn, Oreg	706	1,553/47	17090010
43N	14211720	Willamette River at Portland, Oreg	11,100	36,990/3	17090012
44	14243000	Cowlitz River at Castle Rock, Wash	2,238	9,330/48	17080005
45N	14301000	Nehalem River near Foss, Oreg	667	2,785/36	17100202
46W	14301500	Wilson River near Tillamook, Oreg	161	1,226/45	17100203
47NW	14321000	Umpqua River near Elkton, Oreg	3,683	7,579/70	17100303
48N	14372300	Rogue River near Agness, Oreg	3,939	6,735/15	17100310
49N	10396000	Donner und Blitzen River near Frenchglen, Oreg	200	120/45	17120003

Mean and extreme discharges at 8 long-term stream-gaging stations

Number on map	Stream	Maximum discharge; month-year (cfs)	Minimum discharge; month-year (cfs)	Average discharge; 1941–70 (cfs)	Average discharge (1941–70) by months, expressed as percent of average discharge for entire 30-water-year period											
					Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
					(percent)											
8W	Clark Fork	68,900:5-48	1,000:12-40	7,780	41	46	52	123	284	311	111	44	42	49	50	47
13	Columbia	[a]550,100:6-48	[b]18,000:2-54	101,300	41	41	44	69	172	285	209	111	69	59	53	45
23N	Snake	47,200:6-18	1,250:1-50	10,330	106	110	110	116	103	114	78	78	86	97	99	102
29NW	Salmon	130,000:6-74	1,580:12-32	11,870	37	39	44	103	291	348	120	48	39	44	44	41
32	Snake	[c]369,000:5-48	6,660:9-58	51,840	66	79	90	158	242	228	82	42	43	51	56	64
36N	John Day	42,800:12-64	(d)	2,119	90	135	160	261	255	137	32	9	9	16	30	71
38W	Columbia	1,240,000:6-94	12,100:4-68	188,600	62	70	73	106	183	244	151	81	58	55	57	61
41W	Willamette	[e]348,000:1-23	2,470:8-40	24,780	201	182	130	109	90	57	30	23	26	49	121	188

[a]Maximum discharge known, June 1894, about 680,000 cfs.
[b]Minimum discharge known, Jan. 30 or 31, 1937, about 12,900 cfs.
[c]Maximum discharge known, June 5, 1894, about 409,000 cfs.
[d]No flow for part of Sept. 2, 1966, Aug. 15 to Sept. 16, 1973.
[e]Maximum discharge known, Dec. 4, 1861, about 500,000 cfs.

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR JANUARY AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	January data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean, in °C	Minimum, in °C	Maximum, in °C
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1977	5,226	109	125	1,620	1,180	2,020	0.5	0.5	0.5
	(Morrisville, Pa.)	1945–76 (Extreme yr)	13,040	62 (1951, 1960)	201 (1959)	....	998 (1965)	20,800 (1976)	......	0	7.5
			[10,240[c]]								
04264331	St. Lawrence River at Cornwall, Ontario, near	1977	223,000	166	168	100,000	90,000	107,000	0.5	0	0.5
		1976	246,900	166	168	111,000	94,900	122,000	0.5	0	1.0
	Massena, N.Y. (streamflow station formerly at Ogdensburg, N.Y.)	1966–76	215,900 [223,000[c]]	....	....	......	....	....	......	0	3.0
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss	1977	275,500	181	232	152,000	138,000	166,000	1.0	0	3.5
		1976	711,700	161	204	349,000	282,000	421,000	4.5	4.0	6.5
			[535,400[c]]								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1977	154,900	157	227	....	62,000	101,000	......	0.5	4.0
	(25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1955–76 (Extreme yr)	360,415	98 (1973)	382 (1964)	....	28,500 (1956)	448,000 (1970)	......	0	10.0
			[315,300[c]]								
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1977*	24,300	406	553	34,100	31,400	37,200	0	0	0
		1976	40,400	159	477	40,300	26,700	53,700	0.5	0	4.5
			[32,940[c]]								
	WEST										
14128910	Columbia River at Warrendale, Oreg.	1977**	143,400	....	....	......	....	....	......	......	....
		1976	201,300	79	92	45,800	32,300	57,100	7.0	6.5	8.0
	(30 miles east of Portland, Oreg.; streamflow station at The Dalles, Oreg.)	1968–76	170,900	....	....	......	....	....	......	1.0	6.0
			[112,300[c]]								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Only four dissolved-solid and water-temperature samples were collected because of inclement weather.
**Dissolved-solids and water-temperature records not available.

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR JANUARY ON SIX LARGE RIVERS

The table at left shows dissolved-solids and temperature data for September at six stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). NASQAN, as established by the U.S. Department of the Interior, Geological Survey, is designed to describe the water quality of the Nation's streams and rivers on a systematic and continuing basis, so as to meet many of the information needs of those involved in national or regional water-quality planning and management.

"Dissolved solids," as described in several columns of the table, are minerals dissolved in water and usually consist predominantly of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. These same minerals are among the most common components of the Earth's solid rocks and minerals, but gradually erode and at least partly dissolve as a part of natural weathering processes. Collectively these and other dissolved minerals constitute the dissolved-solids concentration expressed in milligrams per liter (mg/l) or the generally equivalent expression, parts per million (parts of dissolved matter in one million parts of water, by weight). Values of dissolved solids are convenient for comparing the quality of water from one time to another and from one place to another. Most drinking water contains between 50 and 500 mg/l of dissolved solids.

"Dissolved-solids discharge," expressed in tons per day, represents the total daily amount of dissolved minerals carried by the stream and is calculated by multiplying the dissolved-solids concentration (in mg/l) by the stream discharge (in cfs; times a unit conversion factor of .0027). Even though dissolved-solids *concentrations* are generally higher during periods of low streamflow than of high streamflow, the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

WATER RESOURCES REVIEW

JANUARY 1977

Based on reports from the Canadian and U.S. field offices; completed February 10, 1977

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for January based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for January 1977 is compared with flow for January in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for January is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the January flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of January. Water level in each key observation well is compared with average level for the end of January determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels*, unless described otherwise, are from the end of December to the end of January.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

HYDROLOGY AND ENVIRONMENTAL ASPECTS OF ERIE CANAL (1817–99)

The accompanying summary, map, and profile are from the report, Hydrology and environmental aspects of Erie Canal (1817–99), by Walter C. Langbein: U.S. Geological Survey Water-Supply Paper 2038, 92 pages, 1976. This report may be purchased for $1.20 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202, by check or money order payable to U.S. Geological Survey; or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, by check or money order payable to Superintendent of Documents.

The summary is an abridgment, by the author, of the published abstract.

SUMMARY

As the first major water project in the United States, the old Erie Canal provides an example of the hydrological and environmental consequences of water development. The available record shows that the project aroused environmental fears that the canal might be impaired by the adverse hydrologic effects of land development induced by the canal. Water requirements proved greater than anticipated, and problems of floods and hydraulic inefficiencies beset navigation throughout its history.

The project was authorized and begun in 1817. When completed in 1825, the canal had a length of 363 miles and 81 lift locks. The canal, 40 feet wide and 4 feet deep, ran from tidewater at Hudson River near Albany (fig. 1), through a "staircase" of 20 locks, to the Mohawk River at a point above Cohoes Falls (elevation, 160 feet). It then followed the valley plain of the Mohawk until it reached the saddle between the Mohawk drainage and the Great Lakes drainage at about 420 feet elevation near the present city of Rome. From the Rome saddle, the canal went directly westward, crossing the formidable 65-foot Niagara escarpment of limestone by a set of double, combined locks. Turning south, the canal entered Lake Erie at Buffalo (elevation, 572 feet), and so earned its name from its Lake Erie destination. (See longitudinal profile, fig. 2.)

Water supplies were a primary concern for both the planners and the operators of the canal. Water required for lockage, although the most obvious to the planners, proved to be a relatively minor item compared with the amounts of water that were required to compensate for leakage through the bed and banks of the canal. Leakage amounted to about 8 inches of depth per day. The total quantities of water taken into the canal made it the largest hydraulic undertaking of its time in the United States.

The major flood problem was caused by cross-drainage–the small creeks that crossed under the canal in culverts. Washout of culverts was a never-ending source of sporadic disruption of traffic of 1 or 2 weeks duration. Repairs and replacements could not cope with the problem created by deficiency in information about the flood potentials of the small streams.

Environmental anxieties, broached early in the planning of the canal, centered on the potentially adverse effects of land development and deforestation on floods, water supply, and erosion. The flow of rivers did not decrease as originally feared. Land use did not increase the intensity of flooding and so endanger the canal. Viewed first as a conveyor of pure water from Lake Erie to the State, water in the canal became polluted by the wastes from the persons and animals involved in operations. The extent of pollution, however, was within the oxygen assimilation capacity of the water and the canal did not become septic. The canal contained fish life, but its role in the migration of the troublesome sea lamprey and alewife to the Great Lakes remains unclear.

The overriding fact that the initial anxieties of the planners proved unwarranted and that environmental conditions did not become intolerable by the standards of that time probably led to neglect of consideration of environmental risks in subsequent public works practice during the 19th century.

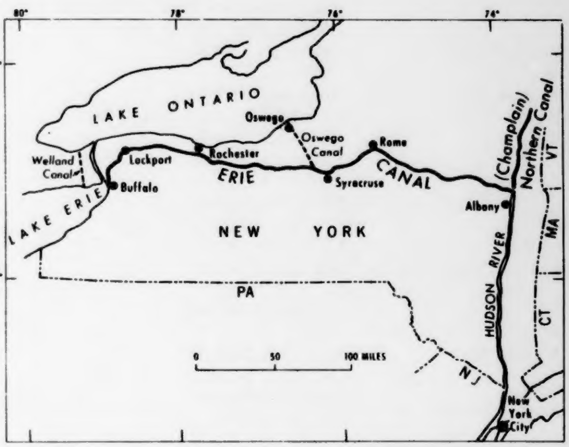

Figure 1.—Route of the Erie and Northern (Champlain) canals.

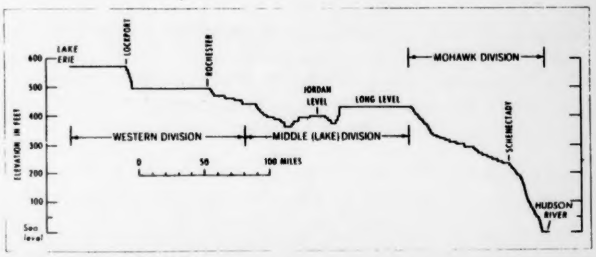

Figure 2.—Longitudinal profile of the Erie Canal.

INT: 1965–77